

CLAIMS

1. A diversity receiving apparatus for receiving signals carrier-modulated by a digital multilevel modulation system by a plurality of branches and for demodulating the signals, the diversity receiving apparatus comprising:

a plurality of demodulation units each provided for each of the plurality of branches, the plurality of demodulation units each outputting complex information indicating a signal point of each of the signals received by the plurality of branches;

a master branch determination unit for determining a master branch which is used as a reference in synchronizing an output timing among symbols of the signals received by the plurality of branches, and for outputting a signal indicating a branch determined to be the master branch;

a timing adjustment unit for receiving the signal indicating the branch determined to be the master branch from the master branch determination unit, and for adjusting a timing of synthesizing the signals received by the plurality of branches by synchronizing the output timing between a symbol of the complex information received from the demodulation unit of the master branch and a symbol of the complex information received from the demodulation unit of a branch other than the master branch out of the plurality of antennas; and

a synthesis unit for synthesizing the signals received by the plurality of branches by using the complex information that has been timing-adjusted by the timing adjustment unit.

2. The diversity receiving apparatus of claim 1 further comprising:

a transmission parameter storage unit, wherein

the plurality of demodulation units each extract a transmission parameter containing information necessary for demodulation from each of the signals received by the plurality of branches, and each output the transmission parameter in addition to the complex signal, and

the transmission parameter storage unit stores the transmission parameters outputted from the plurality of demodulation units.

3. The diversity receiving apparatus of claim 1 further comprising:

a plurality of quadrature detection units each provided for each of the plurality of branches, the plurality of quadrature detection units each outputting a signal indicating synchronization establishment of each of the signals received by the plurality of branches, wherein

the master branch determination unit determines a branch having the quadrature detection unit that is the first to input

the signal indicating synchronization establishment to the master branch determination unit to be the master branch.

4. The diversity receiving apparatus of claim 1 further comprising:

a plurality of tuners each provided for each of the plurality of branches, the plurality of tuners each extracting a signal at specific frequencies from each of the signals received by the plurality of branches, and each outputting information about average electric power of each of the signals received by the plurality of branches, wherein

the master branch determination unit determines a branch having a highest average electric power of the signal received to be the master branch.

5. The diversity receiving apparatus of claim 1 further comprising:

a plurality of tuners each provided for each of the plurality of branches, the plurality of tuners each extracting a signal at specific frequencies from each of the signals received by the plurality of branches, and each outputting information about fluctuation in electric power of each of the signals received by the plurality of branches wherein,

the master branch determination unit determines a branch having least fluctuation in the electric power of the signal

received to be the master branch.

6. The diversity receiving apparatus of claim 1, wherein
the plurality of demodulation units each calculate an average amount of noise from each of the signals received by the plurality of branches and each output the average amount of noise; and

the master branch determination unit determines a branch having least average amount of noise outputted from the demodulation unit to be the master branch.

7. The diversity receiving apparatus of claim 1, wherein
the plurality of branches each have an antenna with directional characteristics; and

the master branch determination unit determines a branch having an antenna with directional characteristics in a direction of a transmitting station to be the master branch.

8. The diversity receiving apparatus of claim 7 further comprising:

a GPS capable of locating a position of a receiving apparatus; and

a gyro sensor capable of locating a direction of a receiving apparatus, wherein

the master branch determination unit selects an antenna

with directional characteristics in a direction of a transmitting station based on the GPS and the gyro sensor, and determines the antenna to be the master branch.

9. The diversity receiving apparatus of claim 1 further comprising:

a GPS capable of locating a position of the diversity receiving apparatus; and

a communication unit capable of bidirectional communication, wherein

the master branch determination unit transmits positional information of the diversity receiving apparatus located by the GPS to a server having information about master branch determination, and receives the information about master branch determination from the server, thereby determining a branch having an antenna with directional characteristics in a direction of a transmitting station to be the master branch.

10. The diversity receiving apparatus of claim 1 further comprising:

a reader capable of reading a recording medium which stores the information about master branch determination, wherein

the master branch determination unit determines a branch

having an antenna with directional characteristics in a direction of a transmitting station to be the master branch, based on the information about master branch determination that has been read from the recording medium by the reader.

11. The diversity receiving apparatus of claim 1, wherein the master branch determination unit determines a new master branch by selecting the new master branch among branches that can receive signals when the master branch gets into bad receiving condition and it becomes impossible to detect symbol synchronization.

12. The diversity receiving apparatus of claim 11, wherein the master branch determination unit stores receiving status data before the master branch gets into bad receiving condition; and determines the new master branch based on the receiving status data.

13. The diversity receiving apparatus of claim 12, wherein the master branch determination unit stores, as the receiving status data before the master branch gets into bad receiving condition, the signals each indicating synchronization establishment of each of the plurality of branches; and determines a branch that is the last to input the signal indicating synchronization establishment to the

master branch determination unit before the master branch gets into bad receiving condition to be the new master branch.

14. The diversity receiving apparatus of claim 12, wherein the master branch determination unit stores, as the receiving status data before the master branch gets into bad receiving condition, average electric power received by each of the plurality of branches; and determines a branch that has had highest average electric power received before the master branch gets into bad receiving condition to be the new master branch.

15. The diversity receiving apparatus of claim 12, wherein the master branch determination unit stores, as the receiving status data before the master branch gets into bad receiving condition, fluctuation in electric power received by each of the plurality of branches; and determines a branch that has had least fluctuation in the electric power received before the master branch gets into bad receiving condition to be the new master branch.

16. The diversity receiving apparatus of claim 1, wherein the master branch determination unit determines a new master branch even when it becomes impossible to detect symbol synchronization because the master branch gets into bad

receiving condition, and there is no other branch that can receive a signal.

17. The diversity receiving apparatus of claim 2, wherein the transmission parameter storage unit stores the transmission parameter that is the first to be outputted from the plurality of demodulation units after channel selection, the transmission parameter being used to demodulate the signal received by a corresponding one of the plurality of branches.

18. The diversity receiving apparatus of claim 2, wherein the transmission parameter storage unit stores the transmission parameter that is the first to be outputted from the plurality of demodulation units after the reception is resumed, the transmission parameter being used to demodulate the signal received by a corresponding one of the plurality of branches.

19. A diversity receiving method for receiving signals carrier-modulated by a digital multilevel modulation system by a plurality of branches and for demodulating the signals, the diversity receiving method comprising:

a demodulation step for outputting complex information indicating signal points of the signals received by the plurality of branches; and

a master branch determination step for determining a master branch which is used as a reference in synchronizing an output timing among symbols of the signals received by the plurality of branches, and for outputting a signal indicating a branch determined to be the master branch.

20. The diversity receiving method of claim 19, wherein

the master branch determination step comprises:

a step for determining a next candidate for the master branch; and

a step for replacing a current master branch with the next candidate for the master branch when the current master branch gets into bad receiving condition.